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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/693,418	10/20/2000	Brian M Burmaster	ENV 9851.1	1265

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SENNIGER POWERS LEAVITT AND ROEDEL
ONE METROPOLITAN SQUARE
16TH FLOOR
ST LOUIS, MO 63102

EXAMINER
VANOY, TIMOTHY C

ART UNIT	PAPER NUMBER
1754	12

DATE MAILED: 07/17/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

SM

Office Action Summary

Application No.	Applicant(s)
09-693,418	BURMASTER et al.
Examiner	**Group Art Unit**
VANOY	1754

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE THREE — MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) ~~filed~~ on date-stamped June 20, 2002 and date-stamped Apr. 26, 02

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Dispositi n of Claims

☒ Claim(s) 1-42 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-42 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Applicati n Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☒ ~~The drawing(s)~~ Fig. 1 filed on Oct. 20, 00 is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____.

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____.

Attachment(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 9

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice f Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Revi w, PTO-948

☐ Other _____

Office Action Summary

DETAILED ACTION

Drawings

a) Fig. 1 is again objected to as failing to comply with 37 CFR 1.84(p)(4) because the reference character "39" has been used to designate both the line feeding into "gas mixer" 23 and the "incinerator". A proposed drawing correction or corrected drawing is required in reply to the Office Action to avoid abandonment of the application. The objection to the drawing will not be held in abeyance.

The "Letter to the Official Draftsman" dated June 20, 2002 (paper no. 11) has been received, which submits that one sheet of corrected formal drawing has been submitted with the Letter to replace the drawing now on file. The Applicants are advised that there is no corrected formal drawing present in this application file. The Applicants are also advised that the amendments to the specification, which change "incinerator 39" to "incinerator 40" have been entered, such that the new corrected drawing must reflect these amendments.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

The person having "ordinary skill in the art" has the capability of understanding the scientific and engineering principles applicable to the claimed invention. The references of record in this application reasonably reflect this level of skill.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Pat. 4,088,743 in view of U. S. Pat. 5,851,265 and pgs. 420 and 451-462 in the Gas Purification (4^{th} ed.) book by Kohl et al.

Fig. 2 and the description of Fig. 2 set forth in col. 15 ln. 55 to col. 17 ln. 44 in U. S. Pat. 4,088,743 discloses a process for treating a hydrogen sulfide-containing gas ("geothermal steam" (40)), comprising:

passing a portion (via lines 50, 70, 150, 1, 15, 17, 18 and 24) of this hydrogen sulfide-contaminated geothermal steam (40) into an oxidation reactor (25), where the hydrogen sulfide reacts with air (20) to form elemental sulfur by *first* reacting the hydrogen sulfide with the air to form sulfur dioxide, and *then* reacting the sulfur dioxide with the residual hydrogen sulfide to form elemental sulfur and water (please see col. 6 lns. 1-2 reactions (I), (II) and (IV));

passing the resulting elemental sulfur-containing gas (26) through a condenser (27), where elemental sulfur is condensed and removed from the gas via line (28);

passing a portion of the resulting, sulfur-free gas (via lines 29, 30, 5, 7, 9 and 10) into an incinerator (11) to oxidize residual sulfur species in this gas into sulfur dioxide (please see col. 3 lns. 1-18, for example);

passing this resulting sulfur dioxide-containing incinerator off-gas (12) to a "SO_2 scrubber" unit (180) via line 170, where the sulfur dioxide is scrubbed out of the gas and the cleaned gas is vented via line 200, as set forth in at least Applicants' claims 1 and 2.

The difference between Applicants' claim 1 and U. S. Pat. 4,088,743 is the manner in which the sulfur dioxide is scrubbed out of the incinerator off-gas (12) in that Applicants' claim 1 requires the sulfur dioxide-containing off-gas to be contacted with liquid absorbent; stripping the sulfur dioxide out of the liquid absorbent and recycling the regenerated absorbent back to the scrubbing zone (whereas U. S. Pat. 4,088,743

simply scrubs the gas with a lime-containing aqueous solution in which at least a portion of it is discarded: please see Fig. 2).

U. S. Pat. 5,851,265 describes the same process for treating the off-gas from an incinerator in a Claus plant (please see col. 5 lns. 48-52) by passing the off-gas into a sulfur dioxide absorber (11) where the sulfur dioxide is sorbed out of the off-gas and into the absorption liquid, thereby producing cleaned gas (which is discharged from the sulfur dioxide absorber (11)) and a sulfur dioxide-loaded absorption liquid (16) which is passed through a sulfur dioxide stripper (22) where the sulfur dioxide is transferred from the absorption liquid into a stripping gas (26) (please see col. 6 ln. 19 to col. 8 ln. 12 and Fig. 3).

The regenerated absorption liquid is recycled back to the sulfur dioxide absorber (11) via line (14) (please see col. 7 lns. 59-66), while the sulfur dioxide-containing stripper gas may be fed into a Claus plant for recovery of elemental sulfur (please see col. 9 lns. 45-47).

It would have been obvious to one of ordinary skill in the art at the time the invention was made *to modify* the Claus process illustrated in Fig. 2 in U. S. Pat. 4,088,743 *by feeding* the sulfur dioxide-containing incinerator off-gas to the sulfur dioxide absorber (11) in U. S. Pat. 5,851,265 and processing this incinerator off-gas according to the process described in col. 6 ln. 19 to col. 8 ln. 12 in U. S. Pat. 5,851,265 (*instead of* passing this incinerator off-gas through the "SO_2 scrubber" illustrated as feature 180 in Fig. 2 in U. S. Pat. 4,088,743), in the manner required by at least Applicants' claim 1, *because* of the expected advantage of recovering the sulfur dioxide

within the incinerator off-gas in the form of elemental sulfur via treatment in the Claus plant mentioned in col. 9 lns. 45-47 in U. S. Pat. 5,851,265 (which would be the "oxidation reactor" 25 illustrated in Fig. 2 in U. S. Pat. 4,088,743 in making this modification) *rather than* wasting the sulfur dioxide within the incinerator off-gas by simply allowing it to be discharged out of the "SO_2 scrubber" 180 in form of *(evidently)* calcium sulfite-containing waste or an aqueous solution of sulfuric acid, as illustrated as features 210 and 220 in Fig. 2 in U. S. Pat. 4,088,743. In substituting the sulfur dioxide scrubbing system of U. S. Pat. 5,851,265 in lieu of the "SO_2 scrubber" (180) in U. S. Pat. 4,088,743, the sulfur dioxide-containing incinerator off-gas (170) illustrated in Fig. 2 in U. S. Pat. 4,088,743 would be fed to the "SO_2 absorber" (11) illustrated in Fig. 3 in U. S. Pat. 5,851,265 and the sulfur dioxide-containing tail gas (48) illustrated in Fig. 3 in U. S. Pat. 5,851,265 would replace the "air" illustrated as feature "20" in Fig. 2 in U. S. Pat. 4,088,743. Obtaining *even more* elemental sulfur from the wasted sulfur dioxide/calcium sulfite values that would have been discharged out of the process of U. S. Pat. 4,088,743 via lines 210 and 220 would appear to be consistent with the field of endeavor of U. S. Pat. 4,088,743.

The limitation set forth in Applicants' claim 1 lns. 35 et seq. describing the effect that the recycled sulfur dioxide-containing stripper gas has on the temperature in the catalytic reactor is noted, but such description of the advantages of doing what is obvious from the prior art is *prima facie* obvious: please see the discussion of the court decisions set forth in section 2145(II) in the MPEP (8^{th} ed.) for further details.

While U. S. Pat. 4,088,743 does not describe the details of the Claus catalyst used as recited in (at least) Applicants' claim 3, pgs. 457, 2nd full paragraph in the Gas Purification text by Kohl et al. renders obvious the choice of the alumina catalyst, set forth in at least Applicants' claim 3. It would have been obvious to one of ordinary skill in the art at the time the invention was made *to modify* the process of U. S. Pat. 4,088,743 *by substituting* the alumina catalyst described on pg. 457, 2nd full paragraph in the Gas Purification text *in lieu of* the catalyst used in the "oxidation reactor" (25) illustrated in Fig. 2 in U. S. Pat. 4,088,743, in the manner required by at least Applicants' claim 3, *because* of the expected advantages of high catalyst activity, resistance to attrition, etc. attributed to this alumina catalyst as set forth on pg. 457, 2nd paragraph in the Gas Purification text by Kohl et al.

Note that pg. 456 lns. 1-4 in the Gas Purification book reports that the temperatures that the catalytic stages operate at are between the sulfur dew point of the gas and 700 °F (371 °C), which renders obvious the temperature limitations of Applicants' claims 2-5 and 7. Due to the exothermic nature of the Claus reaction (please note the reaction associated with the "catalytic stages" illustrated in Fig. 8-16 on pg. 458 in the Gas Purification book), it would also be expected that the temperature of the catalysts, per se, would be somewhat higher than the 700 °F upper limit mentioned on pg. 456 lns. 1-4 in the Gas Purification book – in a manner rendering obvious the limitations of Applicants' claim 6.

Note that pg. 451, last four lines in the Gas Purification book reports that the Claus process can treat pure gaseous hydrogen sulfide or acid gas streams containing

hydrogen sulfide in high concentrations, in a manner that is not seen to be unobviously distinct from the limitations of Applicants' claims 8-11, and also note that the paragraph bridging pgs. 451 and 454 in the Gas Purification book reports that the hydrogen sulfide containing gas may be derived from acid gases stripped from alkaline solutions or physical solvents used for the purification of sour gases (natural gas is mentioned on pg. 420 in the Gas Purification book), in a manner rendering obvious the limitations of Applicants' claims 12 and 13.

Note that col. 10 lns. 28-30 in U. S. Pat. 5,851,265 reports that the stripper gas may have a strength of 20 to 95% by volume, in a manner rendering obvious the limitations of Applicants' claims 14 and 15.

Note that col. 8 lns. 56-58 in U. S. Pat. 5,851,265 reports that the preferred operating pressures in the stripper range from 20 to 150 kPas., in a manner rendering obvious the limitations of Applicants' claim 16.

Note that the last three lines at the bottom of pg. 461 in the Gas Purification book reports that the H_2S:SO_2 mole ratio should be 2:1 and that this ratio is expected to be higher when the sulfur dioxide-containing stripper gas of U. S. Pat. 5,851,265 is mixed in with the feed gas entering the catalytic stage – in a manner rendering obvious the limitations of Applicants' claim 17, and also note that the comment set forth in the sentence bridging pgs. 461 and 462 in the Gas Purification book reports that appreciable deviation from the H_2S:SO_2 mole ratio from the 2:1 mole ratio leads to drastic reduction in conversion efficiency, in a manner rendering obvious the limitations of Applicants' claim 18.

Note that col. 5 lns. 58-61 in U. S. Pat. 5,851,265 reports that the "source gas", which may originate from the incinerator of a Claus plant, may contain from 0.1 to 5 volume percent sulfur dioxide, in a manner rendering obvious the limitations of Applicants' claim 20.

Note that col. 5 lns. 20-21 and the "Example" set forth in col. 12 in U. S. Pat. 5,851,265 reports the use of dibutyl butyl phosphonate (in its discussion of the liquid solvents set forth in col. 4 lns. 30 et seq.), in a manner that is submitted to meet the limitations of Applicants' claims 19, 21, 22 and 23. Also note that the discussion of the prior art organic solvents set forth in col. 2 lns. 2-4 in U. S. Pat. 5,851,265 renders obvious the tetraethylene glycol dimethyl ether mentioned in Applicants' claims 24 and 25.

Note that as the sulfur dioxide-containing stripper gas of U. S. Pat. 5,851,265 is recycled to the gas entering the Claus catalytic stage illustrated in Fig. 8-16 on pg. 458 in the Gas Purification text operating at the temperatures ranging from the dew point of sulfur to 700 °F (371 °C): please see lns. 1-4 on pg. 456 in the Gas Purification book, the same oxidation of the same soot deposited on the same catalyst is expected to inherently occur (consistent with the disclosure set forth on pg. 463, 1st and 2nd full paragraphs in the Gas Purification book), rendering obvious the limitations of Applicants' claims 29, 31 and 32.

Note that Fig. 2 features 260, 280 and 10 in U. S. Pat. 4,088,743 illustrates bypassing a portion of the geothermal steam around the "oxidation reactor" 25 and

directly injecting it into the incinerator 11, in a manner that fairly suggests the limitations of Applicants' claims 30 and 32.

Note that col. 15 lns. 55 et seq. in U. S. Pat. 4,088,743 discloses that the hydrogen sulfide-contaminated geothermal steam is subjected to an acidic water wash in washer 80 before it is injected into the oxidation reactor 25, in a manner suggesting the limitations of at least Applicants' claim 26. The water used to wash the gas appears to be water containing dissolved sulfur dioxide at a pH of 5.5 to 7.5 (please compare this water containing dissolved sulfur dioxide and at a pH of 5.5 to 7.5 to the "aqueous acid wash comprises sulfuric acid" set forth in Applicants' claim 27): please see col. 16 lns. 47-56 and also features 230, 120, 90 and 100 illustrated in Fig. 2 in U. S. Pat. 4,088,743.

While it is granted that U. S. Pat. 4,088,743 does not disclose that the washing step results in the olefins and/or aromatics in the gas reacting with the aqueous solution containing sulfuric acid to produce sulfate salts, in the manner set forth in at least Applicants' claims 26-28, 33-35 and 39, it is submitted that this difference would have been obvious to one of ordinary skill in the art at the time the invention was made *because* these same olefins and/or aromatics mentioned in Applicants' claims 26-28, 33-35 and 39 are *expected to be inherently present* in the same gases mentioned in the hydrogen sulfide-containing feed gas mentioned in Applicants' claims 12 and 13 as well as in the paragraph bridging pgs. 451 and 454 in the Gas Purification book which reports that the hydrogen sulfide containing gas may be derived from acid gases stripped from alkaline solutions or physical solvents used for the purification of sour

gases (natural gas is mentioned on pg. 420 in the Gas Purification book). Obviously, the *same* hydrocarbon contaminants will inherently react with the *same* aqueous solution of sulfuric acid used as the wash solution in the "washer" 80 illustrated in Fig. 2 in U. S. Pat. 4,088,743 in the same manner set forth in the Applicants' claims.

The limitations of Applicants' claims 36-38 describing the concentrations of the hydrocarbons in the gas before and after the washing step are noted, but are submitted to be obvious in as much as the same gas subjected to the same washing step will inherently have the same claimed concentrations of the hydrocarbons before and after this washing step, as reported in Applicants' claims 36-38.

The limitations of Applicants' claims 40-42 are noted, but are submitted to be obvious because of the expected advantage of the claimed "mist eliminator" to remove liquid out of the gas before the gas is injected into the "oxidation reactor" 25.

Response to Arguments

The Applicants' arguments submitted in their Amendment dated June 20, 2002 (paper no. 10) have been fully considered but they are moot in view of the new grounds of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy C. Vanoy whose telephone number is 703-308-2540. The examiner can normally be reached on 8 hr. days.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman, can be reached at 703-308-3837. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Timothy Vanoy/tv
July 15, 2002

Timothy Vanoy
Patent Examiner

Art Unit 1754

Wayne A. Langel
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